



Clusters and Competencies: Workforce Development and South Carolina's Economy

A Report to

The South Carolina Policy Council

In cooperation with

*The South Carolina Manufacturer's Alliance, and
The South Carolina Business and Industry Political Education Committee*

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March 2004

TABLE OF CONTENTS

Introduction	1
Executive Summary.....	3
Prologue	10
The Context: South Carolina's clusters	11
Demystifying clusters	11
Mapping the new geography of economic development.....	12
A Competency-Based Approach to Clusters.....	15
Workforce Education in South Carolina.....	20
Measuring up	21
The system and the mid-skilled labor force.....	22
Supplementing the system	24
Aligning Workforce Development with Demand-Driven Clusters.....	26
Choosing the right clusters	26
Framework for cluster hubs at SC's technical colleges	27
The current state of cluster specialization.....	30
Examples of prototype SC clusters.....	32
Principles underlying cluster hubs.....	35
Functions of cluster hubs	37
Conclusions: In Support of a Cluster Strategy.....	43

INTRODUCTION

Clusters and Competencies: Workforce Development and South Carolina's Economy

The intent of this report is to expand the discussion of South Carolina's economic future. Much of that discussion recently has focused on a research-based economic development strategy. While research is critical to our state's ability to compete in the future, such a strategy is only valuable to South Carolina if it includes an educated work force. Our state's economic vitality depends on a comprehensive strategy that includes both research based innovation and the workforce necessary to advance it.

Research alone is not sufficient to create and sustain a vibrant innovative economy. If we are to reap the benefits of successful research, we must have the ability to turn ideas into industry. If we fail to do that, those ideas will leave South Carolina and produce businesses in other states. Fortunately, South Carolina has a technical college system in place to educate workers to meet both the current and future needs of industry. Commerce Secretary Bob Faith recently pointed out that South Carolina's research philosophy would fail without the type of work force that is educated by the technical colleges. In today's labor market, 85 percent of employees need an education beyond high school in order to succeed. South Carolina already has a successful technical college system in place to provide that education.

Today's industry is comprised not only of high-tech manufacturing businesses, but also of health care providers and service businesses that are dependent on the

technical skills of their workers. The days of low wage assembly jobs in our state are long gone, and must be replaced with higher-paying jobs that are filled by people with advanced technical skills. In fact, many jobs today incorporate technology that was not available even ten years ago. Because technology will only continue to advance, South Carolina's economic development strategy must be based on the following assumptions:

- South Carolina is facing a critical shortage of technically prepared workers today - we must advance educational policies that allow more South Carolinians the opportunity to raise their income.
- The innovation economy is dependent upon the South Carolina Technical College System to work. Otherwise our major export will not be products, it will be ideas and research-based technology.
- South Carolina's employers are demanding qualified, trainable workers. Our state is dependent upon the technical colleges to produce them, not only to support current business needs but also to attract new companies that create new jobs.
- Technical colleges must be included in any strategy to support economic growth because all jobs require technical skills.

The South Carolina Policy Council

EXECUTIVE SUMMARY

Clusters and Competencies: Workforce Development and South Carolina's Economy

Situational overview:

South Carolina is crossing the threshold of a new strategic direction for economic development. Our state is focused on creating a stronger business climate to succeed in a new "Innovation Economy." Such an economy will involve research and development as well as technology-based businesses and high-tech manufacturing companies. Steps have been taken to begin driving our economy forward, including investment in our state's research capacity. Research can and should be a catalyst for economic development in SC because it can create a resource core of cutting edge knowledge.

To leverage our state's research potential, many business leaders in South Carolina have embraced the industry cluster concept as a viable approach to economic development. In September 2002, the Palmetto Institute commissioned a cluster study from DRI-WEFA, Inc., *The South Carolina Challenge: Regional Economic Analysis*. On December 8, 2003 the South Carolina Department of Commerce released a cluster study conducted by the Monitor Group that established a framework for guiding future economic development in South Carolina.

The focus on research can result in cutting edge job creation and development. An excellent example of this potential is the upstate ICAR project that is geared to create a new center of excellence for the automotive industry. This project is supported by a strong partnership between private business, BMW North America, Clemson University and several of the technical colleges. It is critical that our state create more economic opportunities like ICAR. In order to do that, South Carolina needs to combine a focus on research innovation with some enhancements to our current education system. This strategy will allow our state to remain competitive by supporting the current workforce needs of competitive industries, while at the same time working toward the Governor's goal of creating new jobs and raising income levels in South Carolina. Without this comprehensive strategic focus, the state may not produce new jobs in great numbers and in fact, its greatest export may very well become intellectual capital, rather than goods and services.

One of the most valuable tools in a successful economic development strategy is our state's two-year technical college system. An increased focus on research will create new ideas and technology, and we must have the infrastructure in place to

ensure that businesses and industries across the state can capitalize on them. In other words, to make an economic impact for a majority of state residents, those technologies must be commercialized here at home. The technical colleges will be critical partners that can ensure the success of new startups and technology innovators by preparing the workforce necessary to succeed.

Clusters are the new focus:

South Carolina, like many states, is in the midst of reshaping its economic development strategies to address the collective rather than individual needs of industries. This collective focus is known as “industry clusters.” Clusters have enhanced the strength of regional economies and become a common goal of public sector economic development. They are simply aggregations and alliances of related companies within a given area that have common business needs including similar suppliers, processes, and work force skills. As the state’s cluster-based strategy evolves, one thing is certain: ultimately the competitiveness of South Carolina’s economy will rest heavily, as it has for some time now, on the skills and abilities and size of its work force.

Independent studies carried out in 1995, 2001, and, most recently, 2003 mapped South Carolina’s economy, identified key existing and potential clusters, and suggested policies to develop and grow clusters that would be internationally competitive. Studies of numerous clusters across the U.S. and in other industrialized nations prove that nothing is consistently more important to the success of more clusters than their human resources. The skill requirements to growing and emerging clusters will be much higher than in the past. Nothing is more critical to the success of clusters than South Carolina’s education policy, which has a direct impact on the education and training of the workforce. This report suggests ways to organize the state technical college system to ensure a sufficient pool of employees with the appropriate skills and knowledge to support competitive clusters.

A competency-based approach to clusters

Clusters, at their most basic level, represent a collection of focused skills and knowledge that are embodied in their labor forces. The innovations, foresight, entrepreneurship, leadership, and productivity of managers, researchers, support staff, and line workers are what give clusters their competitive advantages and sources of growth. The advantages that clusters provide are:

1. *Companies are most likely to choose to do business in a place in which a skilled workforce is rooted, ready and able to learn new skills.* The specific

competencies *that are associated with place* give value-added clusters the depth that provides regional advantage and the breadth that allows for selected forms of expansion and diversification.

2. *One of the major factors, in fact many times the major factor that promotes cluster growth is access to a specialized labor force.* While supplies, expertise, R&D, and information, and even professional employees, can be found in and acquired quickly virtually anywhere, the mid-skilled work force and knowledge associated with it is rarely acquired from a distance. Labor is, in fact, the defining issue for a large number of cluster organizations.
3. *South Carolina's technical colleges are focused on local economies and were explicitly designed to address economic development.* The technical college system is charged with the dual mission of preparing learning opportunities for human resource *and* economic development. The colleges' programs and services are intended to be easily accessible for local and commuting students as well as for nearby firms.
4. *A knowledgeable labor force adds value by giving clusters a significant competitive advantage. It also allows clusters to diversify into complementary products or services when market conditions demand change.* Most of the skills and knowledge developed within a cluster have some transferability to new types of business applications, which is why understanding local competencies is so important.
5. *Most of the innovations that create competitive advantage within clusters are generated by incremental improvements made by line staff, transferred informally through employee and market relationships and receive little, if any, public recognition.* Innovation is distinguished from the other learning processes because it is usually the result of discoveries made on the job. Small adjustments made by creative technicians add up to considerable improvements that result in smoother and more efficient operations, more desirable products, or higher quality.

Workforce education in South Carolina

How does South Carolina stack up against other states? The most common criticism of South Carolina's work force is low educational attainment levels, a serious concern considering that the foundation skills and knowledge, and many of the work habits of the state's future workforce are formed in K-12 education systems. Far too many young people still fail to complete high school. There is some evidence that South Carolina's educational reforms, such as the 1998 Accountability Act, have resulted in small student achievement gains. In addition,

South Carolina has moved up to eighth among 16 southern states in both proportion of adults with high school diploma or GED (76.3 percent) and with bachelor's degree or higher (20.4 percent).¹

The state's high school graduation rate is well below the national average, however the proportion of those that do graduate and subsequently enter postsecondary institutions is well above the U.S. average. More than half of all first-time freshmen in South Carolina's public postsecondary system are in technical college, where enrollments in credit programs have risen by more than 30 percent over the past decade. The sixteen technical colleges last year served nearly 100,000 credit students and 126,000 non-credit continuing education students. Ninety five percent of all technical college students remain to live and work in the state. Technical colleges are the state's premier institutions of lifelong learning and the gateway to economic opportunity for less advantaged, minority populations, immigrants, and the incarcerated; displaced and underemployed workers, career changers, and discharged military; the highly educated and the barely literate.

The technical college system has many other strengths, not the least of which is its industrial training programs -- now the Center for Advanced Technology Training -- that has consistently played a large part in the state's success in industrial development. Another is its accessibility to underemployed working adults who lack the foundation and technical skills necessary to perform in the clusters identified as significant to the future of South Carolina. The technical colleges are intermediaries that can translate the demands of clusters to the local adult working population as well as prepare the future workforce with the necessary skills to operate within the clusters.

There is a need to continue reforms that will help to equip more individuals for the work place. Currently, it is estimated that 40 percent of South Carolinians do not have the general education skills to make SC competitive in the new economy. Also, 20 percent (about 600,000) do not have a high school diploma or are functionally illiterate. Another 20 percent are currently employed in low skilled jobs (some functionally illiterate who learned their jobs by observation) and do not have the ability to help their companies utilize the technology that will enable them to compete in the new economy.

Aligning the State's Technical College System with Research Development and K-12 to meet Cluster workforce needs

¹ Southern Regional Educational Board, *SREB Fact Book 2003*, www.sreb.org/main/EdData/FactBook/indexoftables03.asp.

The concept of a cluster-oriented technical college system is based on several assumptions. First, that all sectors of education including K-12, technical colleges and research institutions, are aligned to ensure that more people get the education necessary to succeed, and to ensure that work force demands of business and industry are addressed. To do this, technical colleges must continue to develop partnerships with research universities to fully leverage the efforts of the endowed chairs program and to ensure that research centers of excellence have available the full range of workforce skills required to commercialize new technologies.

Additionally, in the future, every technical college will not have the resources to provide high quality education, training, and services to all industries -- only by specializing can institutions and systems assemble expertise and resources to achieve excellence and ensure that employment in clusters spans a wide range of technical and non-technical occupations. A great deal of natural alignment already exists within the state's technical college system, in part through a derivative of the state's technology centers and in part through a response to regional customer demand. Colleges have their own particular specialties that are specifically focused on local business demands. The key to further alignment with industry clusters is to enhance program specialization to meet industry skill demands and to promote business growth by providing services that more directly serve clusters.

One approach is the "cluster hub," the next generation of technical college-based centers of excellence. Cluster hubs, however, address clusters' needs in different ways. The following table lists various functions that are carried out by some colleges to *complement or supplement education and training programs*. No college has attempted to do everything suggested below. The priorities for any Hub depend on availability of resources, internal capacity and expertise, firms' access to other support agencies or service companies for these functions, and the needs of the cluster. Typically, in rural areas where fewer sources of support and expertise for employers are available, colleges do more than in large metro areas. The key to success is enabling the colleges to focus on areas of strength based on cluster demands, and then share that information with other colleges to meet local needs.

Cluster Hub Functions

- ✓ Develop new curricula using direct industry input
- ✓ Monitor cluster trends, assess needs
- ✓ Create skill standards as needed

- ✓ Facilitate workplace learning
- ✓ Participate on cluster councils
- ✓ Promote cluster-related entrepreneurship
- ✓ Conduct global benchmarking, retain global perspective
- ✓ Build regional skills alliances
- ✓ Advance cooperation between all levels of the education system
- ✓ Host and deliver complementary services
- ✓ Provide cluster information portals
- ✓ Be flexible and accountable

Conclusions and Recommended Actions

The central role of skill development and an educated work force in cluster-based strategy is irrefutable, and it is likely to become even more important as more knowledge dependent clusters emerge and grow. South Carolina's system of technical colleges, already nationally recognized in its economic development role, must take the lead to implement the following steps:

1. Align the state's strategic needs to include a workforce development system that provides workers with the skill and context needs of industry clusters.
2. Work with and through cluster organizations in planning, developing, and supporting, cluster-oriented activities.
3. Work with research institutions to develop associate degrees and technical certifications required to provide the workforce essential to commercialize new technologies developed in the state.
4. Build international education into workforce development programs and set globally competitive standards.
5. Continue and expand efforts to reach underemployed workers and increase enrollments and completion from postsecondary programs.
6. Create a seamless and open-ended system of workforce development that identifies students from high school who choose workforce-oriented programs at technical colleges and, for those aspiring to higher levels, directs them on to baccalaureate programs.

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PROLOGUE

South Carolina is embarking on a new path to economic development that recognizes the competitive advantages of proximity and interaction between competitive companies and the institutions on which they depend. As that strategy develops across the state, one thing is certain: ultimately the competitiveness of the economy will continue to rely on the abilities of its work force.

South Carolina was among the first states to realize and act on the importance of workforce development. In 1979, the State of South Carolina produced a comprehensive strategy for workforce and economic development. Long before the term *industry cluster* assumed its present meaning, South Carolina looked at its industrial base, identified its competitive advantages and created its technical colleges to educate a skilled work force to ensure its most important industries would remain competitive and grow. Individual technical colleges were assigned lead responsibilities for developing specific expertise in sectors important to their region's economy. The colleges focused on their local economies and understood both the employment and technology needs of their business customers.

South Carolina has long been recognized as a breeding ground for innovative partnerships that focused on the needs of employers and the work force. An example of this leadership was demonstrated in 1990 when the National Institute for Standards and Technology chose South Carolina as one of the first sites for manufacturing technology centers to support the modernization of small and mid-sized enterprises (SMEs). The technical college system was, from the outset, a critical partner of the University of South Carolina.² The relationship proved to be a model for other states and highlighted the force of two-year colleges in promoting industrial modernization. This early partnership produced the current national Manufacturing Extension Partnership and provides the foundation for additional partnerships to promote economic vitality in South Carolina.

² The Consortium for Manufacturing Competitiveness, an alliance of 14 southern community colleges under the Southern Growth Policies Board, was the partner funded to provide regional outreach to SMEs across the South.

THE CONTEXT: SOUTH CAROLINA'S CLUSTERS

Not everything that can be counted counts, and not everything that counts can be counted.

Albert Einstein

South Carolina, like many states, is in the process of reformulating its economic development strategies to address the collective rather than individual needs of industries—as “industry clusters.” Clustering among like and complementary businesses, first noticed and described a century ago, is now a documented strength of regional economies and a common goal of public sector economic development strategies. Independent studies carried out in 1995, 2001, and, most recently, 2003 each mapped South Carolina’s economy, identified key existing and potential clusters, and suggested policies to make clusters internationally competitive. Because all states and regions are focused on global competitiveness, clusters must be vigilant and continually innovative if they are to stay ahead of competitor regions.

Demystifying Clusters

There is nothing complicated or mysterious about the basic concept of “clusters.” It is, for the most part, the application of common sense and established practice. Clusters exist because managers and entrepreneurs intuitively recognize the economic advantages of scale and proximity. Clusters, at their most basic level, represent a collection of focused skills and knowledge that are embodied in the labor forces. Clusters are able to attract economies of scale and pursue opportunities for joint actions. There must be enough companies to form a high enough level of demand for a region to support suppliers, services, consultants, and labor with more experience and expertise than would be available to a more isolated or distant company. This scale reduces a company’s costs because it increases the competition, expands its choices, and creates closer relationships.

Closeness among companies also creates greater access to the employment information, ideas, knowledge, and innovations that may be intentionally and unintentionally shared at business meetings and through associations, transmitted by vendors or consultants, or shared as employees change jobs and friends discuss work. Proximity allows companies to resolve their problems more quickly and efficiently, and learn sooner and more directly about new and innovative technologies and practices. However, understanding the complex set of relationships that lead companies to cluster is not a simple task and not easily captured by standard data.

Mapping the new geography of economic development

In 2003, the Massachusetts-based consulting firm, The Monitor Group, produced Phase I of a plan titled “The South Carolina Competitiveness Initiative.” This comprehensive plan for the state—as well as two earlier plans, one developed in 1995 by Telesis³ and one in 2001 by DRI-WEFA⁴—is based on a framework that has become the hallmark of leading economic development professionals and consultants around the world. It presumes that economies are represented by an array of the interrelated systems of similar and complementary firms and institutions called “industry clusters.”

Each of the three plans, while different in many respects, recognizes the potential of specialization within the state’s economy and recommended actions that targeted or supported clusters. Telesis did not name specific clusters. DRI-WEFA listed eleven statewide “established clusters,” two commercially based “seed clusters,” and five technology based “seed clusters.” The Monitor Group selected four statewide traded clusters for analysis, provided state-level data on dozens more and included “local (un-traded) clusters.” The Monitor Group also recommended further analysis with local stakeholders to identify other clusters.

Identifying clusters is as much an art as a science and requires, as The Monitor Group very aptly notes, in-depth local knowledge of regional economies and the ways that companies and institutions interact. The Monitor and DRI-WEFA reports assigned names to clusters based on available data and within existing political boundaries. However, there are large numbers of companies that have significant secondary products or critical processes that are not captured by North American Industry Classification System (NAICS). These companies can be

³ Telesis, *Approaching 2000: An Economic Development Vision for South Carolina*, Department of Commerce and Department of Parks, Recreation and Tourism, 1995.

⁴ DRI-WEFA, *The South Carolina Challenge: Regional Economic Analysis*, Columbia: The Palmetto Institute, 2002.

overlooked by analyses that rely on standard data sets. DoubleClick, for example, is more aptly described as an IT company than its NAICS classification of advertising, and Lego is a plastics manufacturer as well as a toy company.

Federal employer databases also miss numbers of entrepreneurial non-employer companies that can represent a significant proportion of the employment base, especially in rural clusters. South Carolina has some 212,000 companies without employees in 2001, plus many more firms not registered.⁵ These include nearly 3,000 in manufacturing; 23,000 professional, scientific, and technical services; and more than 15,000 in administrative, support, waste management and remediation services.

Furthermore, relationships among businesses and even labor markets are not restricted to areas within political boundaries, and therefore it is easy to overlook significant clusters or important elements of clusters that straddle borders. Firms may cluster around less quantifiable factors such as a common culture or language. Places with large numbers of German companies may attract other German-owned companies and Japanese companies may attract other Japanese-owned companies as a result of a particularly supportive social or business environment and language-friendly educational system. South Carolina, for example, has a greater proportion of employees working in international companies than other state in the continental United States. More than 23 percent of the manufacturing workforce is employed in international firms. Various regions in the state have schools for the Japanese, German, and French companies, host international festivals, celebrate international holidays, and generally welcome foreign companies and cultures.

Despite the limitations and caveats, the standard data does provide a useful starting point for taking a closer look at clusters in various regions of the state. As it is supplemented by local information and expertise and tempered by common sense, the relationships that define clusters are likely to become evident.

Each of the three studies of the state's economy made strong suggestions for actions to stimulate cluster-based economic development and each addressed in some way workforce development. Phase I of the Monitor report includes a campaign to enhance education and workforce training and the DRI-WEFA and Telesis studies include recommendations targeting the workforce and technical college system. The Telesis report specifically recommends that the state "strengthen, extend, and focus South Carolina's workforce development" and align the technical college system with the new economic development [cluster] focus areas. The DRI-WEFA report recommended that the state "transform some

⁵ U.S. Census Bureau, *2001 Nonemployer Statistics*, Washington, DC: U.S. Department of Commerce, 2003.

colleges or universities to focus on vocational or technical training that specifically correlate to the industry clusters.” Monitor’s recommendations will be expanded on in Phase II.

Studies of numerous clusters across the U.S. and in other industrialized nations prove that nothing is consistently more important to their success than their human resources. It is also true that the skill requirements for growing and emerging clusters will be much higher than in the past. Clusters develop and grow as the result of business decisions and investments, while the primary responsibility for basic skill development of the work force rests with educational institutions. The remainder of this paper examines competencies, knowledge, and colleges in a cluster-oriented economy and suggests some ways to more efficiently align the state’s educational institutions to ensure that employers have a sufficient pool of employees with the appropriate skills and knowledge to support competitive clusters.

A COMPETENCY-BASED APPROACH TO CLUSTERS

Using the work and workplace of clusters as contexts for education raises awareness of employment opportunities, improves learning, enhances applications of learning, and creates connections between labor markets and employers.

A Governor's Guide to Cluster-Based Economic Development, 2002⁶

Clusters, at their most basic level, represent a collection of focused skills and knowledge that are embodied in their labor forces. Across the board, nothing is more important to clusters than their human resources, and in no area are clusters more dependent on the state, which is still the primary investor in education and training. The innovations, foresight, entrepreneurship, leadership, and productivity of managers, researchers, support staff, and line workers are what give clusters their competitive advantages and sources of growth.

These advantages accrue to clusters as a result of (1) the utilization of many specific resources concentrated in one place—often based on particular skills and culture of the local economy, (2) a critical mass of highly specialized and experienced workers, (3) the local development mission of technical colleges, (4) the scale of opportunities for learning and acquiring tacit knowledge, and (5) under appreciated sources of innovation.

1. *Companies are most likely to choose to do business in a place in which a skilled workforce is rooted, ready and able to learn new skills.*

The specific competencies *that are associated with place* give value-added clusters the depth that provides regional advantage and the breadth that allows

⁶ Stuart Rosenfeld, *A Governor's Guide to Cluster-Based Economic Development*, Washington, DC: National Governors Association, 2002.

for selected forms of expansion and diversification. These competencies are generally held by a mid-skilled work force that has more than a high school education but less than a baccalaureate education. The U.S. Department of Labor (DOL) estimates that 60-65 percent of jobs now require pre-baccalaureate postsecondary education.

That need for postsecondary education is not new to South Carolina. In 1981, former Tri-County Technical College President Don Garrison told a congressional subcommittee that half the workers in his region need postsecondary education. Of the rest, he said, 20 percent need a baccalaureate, 20 percent need a vocational education and 5 percent can get by with a general high school diploma.⁷

These facts were more recently highlighted in an editorial that ran in *The State* newspaper. The opinion article by Commerce Secretary Bob Faith and Midlands Technical College President Barry Russell stated, "If South Carolina wishes to avoid falling further behind other states in measures of socioeconomic well-being, we must recognize this fact: The era of plentiful low-skilled jobs is gone, and it's never coming back. Statistics from the Palmetto Institute indicate that in the 1950s, 20 percent of jobs required a four-year college degree while 65 percent of jobs required no education beyond high school. Today, that same 20 percent of jobs still require a four-year degree. However, 65 percent of jobs now require additional training or education beyond high school. In the future, demand for unskilled workers will continue to decline."

The Chairman of Volkswagen AG's Supervisory Board was quoted as saying "It is not the number of robots and computers, size and technical perfection of work centres, or the degree of automation which will decide upon our future success but our human resources."⁸ Computer chip maker Intel now contracts with two-year colleges to offer associate degree programs inside their facilities.⁹

Now that work has become more cerebral, companies are looking for places that are home to not only more educated, but to experienced and knowledgeable employees. If jobs cannot be quickly learned, it is far better to have access to a labor force with the education and some experience—which is most available where there are large numbers of companies in similar lines of work. A web-based survey of 222 "partners and allies" conducted by the South Carolina Department of Commerce in 2003 found that 76 percent rated a trainable

⁷ Committee on Education and Labor, U.S. House of Representatives, Hearings on Reauthorization of the Vocational Education Act of 1963, February 26, 1981, U.S. Government Printing Office, 1981.

⁸ Carl H. Hahn, *Süddeutsche Zeitung*, March 4, 1993.

⁹ Stuart Rosenfeld, "College/Cluster Connections: Specialization and Competitiveness in Europe and the U.S.," Unpublished report to the Community College Research Center, Teachers College, Columbia University, New York, December 1997.

workforce at the highest level of importance (five in a five point scale), 60 percent gave the technical colleges a rating of five, and 28 percent gave the research universities a rating of five.¹⁰

In contrast to the local focus of technical colleges, the most highly educated professional employees such as upper level managers and researchers are recruited nationally, and even internationally. Technicians, however, are the product of local education and training systems and committed to place. Further, this mid-skilled work force may also be well prepared to work in the growing number of small companies needed to meet the outsourcing needs of large companies.

2. *One of the major factors, in fact many times the major factor that promotes cluster growth is access to a specialized labor force.*

While supplies, expertise, R&D, and information, and even professional employees, can be found in and acquired quickly from virtually any part of the world, the mid-skilled work force and the knowledge associated with it are rarely acquired from a distance. It is no accident that when employers in a cluster organize to identify common interests and needs, workforce ranks high among its priorities. It is, for example, the defining issue for a large number of cluster organizations. Connecticut's plastics and metalworking cluster organizations both formed initially only to address skill and work force issues and later branched into other common areas of interest. The Springfield, Massachusetts metalworking cluster, auto suppliers in Alabama, and information technology in Mississippi all took on workforce development and training as their most pressing and leading issues.

One of the biggest advantages of clustering is that it increases the flow of know-how through the workforce. Know-how, or tacit knowledge, allows employees to attribute meaning to perturbations in the work process and gives them a frame of reference for solving problems. This know-how is acquired largely through personal experience and learning about and from the experiences of others. It is, in large part, why employers value industry experience and prefer to hire employees with some history in the industry.

3. *South Carolina's technical colleges are focused on local economies and were explicitly designed to address economic development.*

¹⁰ A MarketSearch Study, powerpoint presentation, South Carolina Department of Commerce, November 2003.

If the workforce is a highly ranked factor in business location, expansion, and modernization decisions, then the institutions that develop and hone its skills and knowledge are among any cluster's most vital member institutions. As regional institutions, the programs and services of technical colleges are intended to be easily accessible for local and commuting students as well as for nearby firms. The mission of South Carolina's system of technical colleges is to "provide learning opportunities that promote the economic and human resource development of the state." Research universities, which produce more scientific and technological innovations, also are central to—and indeed often define—their local economies, but they are in effect a resource of the state or nation. Their students come from all parts of the state and around the world and their research-based products and knowledge is available to be distributed widely. Technical college faculty members and high school teachers are encouraged to think globally but then to act locally. The technical college system is charged with the dual mission of preparing learning opportunities for human resource *and* economic development. As such, many South Carolina technical colleges maintain local foundations lead by local business leaders whose main goal is to provide private sector stimulation for the institution.

4. *A knowledgeable labor force adds value by giving clusters a significant competitive advantage. It also allows clusters to diversify into complementary products or services when market conditions demand change.*

As they develop, most clusters build deep and sustained relationships within their regions. The histories of some of the most dominant clusters in the world can be traced back for decades, if not for centuries. The ceramic tile cluster around Sassuolo in the Emilia-Romagna region of Italy can trace its roots to the 16th century. The more typical successful cluster, however, has a more contemporary origin. In the 1950s, firms producing upholstered furniture in northeastern Mississippi, semiconductors in Silicon Valley, electronics in southern Scotland, and mobile communications in northern Denmark began to form nascent clusters. Eventually they grew to a scale that attracted suppliers and services, built a large, experienced work force, and developed a reputation as a cluster. But many clusters are not permanent. They have finite life cycles that are affected by changes in consumer taste, the development of new technologies, and new competition. Examples of clusters that mere shadows of their former selves are footwear in St. Louis, beer in Milwaukee, mining in Butte, and tobacco in Durham. Those clusters that are unable to innovate or reinvent themselves slowly fade away.

One of the reasons for the decline of clusters is the lack of appropriate skill development to provide for their transformation. This is precisely why

understanding local competencies is so very important. Most of the skills and knowledge developed within a cluster have some transferability to new types of business applications. The workforce of every cluster has some combination of skills that are common to certain other occupations, to certain other clusters, and to other comparable work environments. Agriculture adapted well to skilled industrial jobs because the educational programs emphasized mechanical and machine skills. In some places, suppliers have turned to new sets of customers or become a cluster in their own right. The Swiss and German companies that serviced their machinery in the textile industry eventually attracted the machine tool builders to the Greenville-Spartanburg area. By the 1960s the skilled labor they brought and trained became the technicians and entrepreneurs that ultimately developed a new identity as an industrial machinery cluster.¹¹ Many of the manufacturing skills used in the metalworking industries apply equally well to plastics, auto suppliers, and industrial machinery. A workforce that has acquired the Good Manufacturing Practices associated with biotechnology can also apply these to other production facilities that require similar levels of cleanliness, from breweries to semiconductors. However, most occupation-based analyses (“occupational clusters”) focus only on the first, the skills that are common to occupations, and not on similarities in work environment, or context.

5. *Most of the innovations that create competitive advantage within clusters are generated by incremental improvements made by line staff, transferred informally through employee and market relationships and receive little, if any, public recognition.*

As Anthony Carnevale explains, “ultimately, innovation is distinguished from the other learning processes because it is embedded in the workaday world. In contrast, the norms of science strive to remove the processes of scientific inquiry and its outcomes from real-world influences... Innovation results from learning by doing and learning by using at work...”¹² Innovation is much more than patentable ideas. Changes in procedures of equipment made on the job or in back offices account for most of what passes for innovation. The small adjustments made by creative technicians can add up to considerable improvements that result in smoother and more efficient operations, more

WORKFORCE EDUCATION IN SOUTH CAROLINA

¹¹ Regional Technology Strategies, Washington, DC: Appalachian Regional Commission, 1996.

¹² Anthony P. Carnevale, *America and the New Economy: How New Competitive Standards are Radically Changing American Workplaces*, San Francisco, CA: Jossey-Bass, 1991, p. 222.

For German and Japanese companies with extremely high technical expectations and quality standards, South Carolina's training benefits and the upstate's technical education resources are major incentives.

World Class, Rosabeth Moss Kantor, 1995¹³

In a detailed study of the growth of foreign manufacturing in upstate South Carolina, Harvard Business School Professor Rosabeth Moss Kantor wrote that “for over thirty years a collaboration led by the state has provided outstanding technical training and has been a vital factor in expanding high-wage manufacturing jobs...” She defines competitiveness in terms of three factors: concepts, competence, and connections, and then uses upstate South Carolina to illustrate a success that clearly rests on the second, competence.

Competence is a set of abilities that are learned over time starting at home, accelerated by the K-12 schools, further developed in postsecondary institutions, refined on the job, and expanded over time by experimentation, practical experience, and additional education and training. All of these comprise the workforce development process.

By the time foreign manufacturing reached cluster proportions in the Upstate, South Carolina's technical colleges already had a long and illustrious history of contributions to economic development. South Carolina's focus on workforce development has been a benchmark for other states since it was first established in 1961 to further develop the state's transition from an agricultural to an industrial economy. In 1979, a special economic development issue of *VocEd* highlighted the state in two separate articles as a place “where technical education means business.”¹⁴ The “Special Schools for Industry Training” program “helped attract more than \$10 billion in new capital investment over the past six years.” Although

¹³ Rosabeth Moss Kantor. *World Class*, New York: Simon & Schuster, 1995.

¹⁴ James Morris, “South Carolina—Where Technical Education Means Business,” *VocEd* 59 (No. 8, November/December 1979), 49:52.

industry clusters had not yet become part of the policy vocabulary, South Carolina already had obvious strengths in textiles, machinery, chemicals, and shipping.

The recent Monitor Group report correctly notes the quality of the technical college system and its responsiveness to businesses. Representatives of all of the clusters praised the technical college system despite low marks for the state's "K-12 and advanced educational systems." Further, the report finds hard working and flexible workers but too few to meet employers' needs.

Measuring up

How does South Carolina stack up against other states? The most common criticism of South Carolina's work force is low educational attainment levels. The 2002 State New Economy Index ranked South Carolina 45th in education level of its manufacturing workforce and 39th in the educational level of its entire workforce. Far too many young people still fail to complete high school.¹⁵

But national statistics show that South Carolina's educational reforms of the past two decades are slowly making a difference. South Carolina moved up to eighth among 16 southern states in both proportion of adults with high school diploma or GED (76.3 percent) and with bachelor's degree or higher (20.4 percent).¹⁶ Although still below the national averages of 80.5 percent and 24.4 percent, these numbers nevertheless show a marked improvement from the 1986 Commission on the Future of the South's report *Halfway Home and a Long Way to Go* when only half the state's adult population had completed high school and a quarter had not gone beyond eighth grade.¹⁷ Since the 1980s the state has instituted a series of effective educational reforms and increased its spending on public schools to where it now ranks 4th among 14 southern states in public school expenditures per pupil.

A recent survey found that only 51 percent of those entering 9th grade graduated, 34 percent entered college, and 14 percent graduated within six years, well below the U.S. averages of 67, 38, and 18 percent and well below the best state's performance of 84, 58, and 28 percent. Nearly half of all who go on to higher education—a third of all high school graduates—enter a technical college.

¹⁵ Although South Carolina may compare more favorably to national averages by separating data for metro and non-metro students, lower achievement or attainment in non-metro areas has no justification.

¹⁶ Southern Regional Educational Board, *SREB Fact Book 2003*, www.sreb.org/main/EdData/FactBook/indexoftables03.asp.

¹⁷ The Report of the Committee on Human Resource Development, *1986 Commission on the Future of the South*, Research Triangle Park, Southern Growth Policies Board, 1986.

The relatively low levels are in part a result of the makeup of the state's economy, which up until the past two decades emphasized low-skill manufacturing and consequently, few educational requirements. But the face of manufacturing is changing. Traditional industries still dominate the landscape but the survivors are changing the way they operate as their wage-based "competitive advantage" disappears and firms move production offshore. Communities in South Carolina must have a much more skilled workforce to compete on new terms in these clusters.

All learning, of course, does not take place in the schools. Educational attainment used alone can paint a deceptive picture of the state's skill base. Conventional measures fail to take into account formal but non-credit learning, informal on-the-job learning, and formal education that does not result in credentials—which together may be more important to some clusters than formal degrees. The crucial comparison is how well the state's total workforce development is serving its people and its employers. Informal learning, sometimes expressed by job requirements requesting credentials *or comparable experience*, is highly valued by some employers. But at the same time it may not serve the best interests of the individual because it lacks the portability and marketability of recognized credentials. Further, an insufficient grasp of basic academic skills acquired in school can limit advancement and ability to learn more technical skills. Many states, through their high school career and technical education and their community college or technical systems, are devising ways to translate work-based learning experiences of working adults into college credits.

Workforce development for the mid-skilled labor force

South Carolina's K-12 schools, technical colleges, and universities are moving toward a seamless statewide system. Each has a different role to play but clear, clean, and straightforward transitions are the keys. Programs such as tech prep, dual enrollments as well as middle colleges and articulation agreements are all efforts to knit together that seamless system.

The foundation for workforce development is set in the K-12 schools. Although the days of rigid differentiation between students in high school vocational and academic tracks has ended, there still is a definitive career and technology education (CATE) program focused on workforce development. Its main delivery system is the 40 some career and technical centers (which house 40 Cisco Networking Academies). These Centers, plus other high school-based programs, served 146,000 high school students in 2003, nearly half from disadvantaged populations. Yet graduation rates among CATE seniors was higher than for non-

CATE students, and, with the new academic standards, they can choose work *or* college.

Students who wish to concentrate in an occupational field can choose from among 13 career clusters, but those choices are overwhelmingly in business, management and administration (about three in five). Only one in twenty chooses manufacturing; one in 100 chooses science, technology, and engineering; one in forty chooses information technology; and one in 20 chooses health science.¹⁸ This suggests a misalignment between labor market needs and students' interests.

The second and largest tier of workforce development is in the state's 16 technical colleges. Nearly a third of high school students enter a technical college, and more than half of all first time freshmen in South Carolina's public postsecondary system are in technical colleges.

- Last year the system served nearly 100,000 credit students and 126,000 non-credit continuing education students, more than half part-time.
- The average age of a student last year was 26, below the national average of 29, but one in four is over 30 years of age; 61 percent were female and 38 percent minority; 85 percent were employed.
- The technical colleges are open door institutions, support lifelong learning, and provide people with second chances. Although a large proportion (25 to 30 percent) must pass remedial courses before entering a program of study, it's a smaller percentage than in most other states.

Many individual technical colleges have developed articulation agreements that allow transfer of some, if not all, credits earned in the technical colleges to four-year institutions. This establishes pathways for graduates to continue on to the baccalaureate level either immediately or at some later date.

Enrollment in credit programs rose by more than 30 percent over the past decade, and many of those students enrolled to get the courses or specific skills needed to improve their value in the work place. The total number of credentials awarded is a fraction of total enrollments in one- and two-year programs. While this may suggest a low completion rate, this situation is also true on a national scale. One explanation is a lack of interest for the one and two-year credentials among employers. Another is recruitment of students by employers before completion—particularly in technical occupations in short supply. Outside of licensed occupations, few job ads specify an associate degree. This leads students to want

¹⁸, Office of career and Technology Education, *Performance Report 2004*, Columbia: South Carolina Department of Education, 2004

to acquire just enough skills for employment or advancement, and not stay to graduate. Many research studies on the impacts of education combine the associate degree with “some college,” thus failing to distinguish the value of completion. For these reasons, completion rates from applied associate of science degree programs may not be a very good indicator of program success.

Of technical college graduates, about 10.9 percent were in college transfer programs, 17.7 percent in industrial programs, and 5.6 percent in engineering programs. Ninety five percent of all students remain to live and work in the state. Even though less than eight percent of South Carolinians hold associate degrees, that number is higher than the national average. South Carolina also awards proportionally more technical degrees than the U.S. on average. The economy, however, still has unmet needs, and the system needs to attract more students.

Supplementing the technical college system

The value of the state’s technical colleges goes far beyond their education mission. In fact, because of the strength of its technical college system, South Carolina is well known nationally and internationally for its strong industrial training program, The Center for Accelerated Technology Training. This program has consistently played a major role in the state’s economic development success and has long been a primary industrial recruitment tool. In fact in response to surveys, companies have cited the Center’s training programs as a primary factor in their decisions to locate in the state.

Technical colleges are institutions of lifelong learning for a diverse group of South Carolinians. One of the most valuable roles of a technical college is to provide opportunities for continued education and employment for less traditional students such as minorities, displaced workers, single parents, career changers and discharged military personnel. The student bodies within the technical colleges reflect the diversity of their communities in terms of age, race, and ethnicity.

There are considerable numbers of low-income working adults who are underemployed because they lack the foundation and technical skills necessary to perform in the clusters identified as significant to the future of South Carolina. Access to good jobs is important to them and their families. To meet the technical training required by SC businesses and industries, including those innovation companies that the state desires to recruit, South Carolina must prepare non-traditional populations for the workforce.

Growing and sustaining clusters also will require a more educated and trained incumbent workforce. Among the state’s higher education institutions, technical

colleges are the most cost efficient, inexpensive, accessible, and experienced in adult learning. They are, therefore, the obvious sector to accept this challenge and bridge the needs of specific clusters to the skill sets of the local population. The colleges become the intermediaries for translating the demands of clusters to the local adult working population as well as prepare the future workforce with the necessary skills to operate within the clusters. To simply urge that all adults need at least a high school diploma, while certainly laudable in raising educational levels, does little to prepare individuals for the skills necessary to be gainfully employed within the cluster.

Perhaps the most underrated and undervalued contribution of technical colleges to technology-based development is a culture that promotes collaboration, interaction and learning between different organizations. At the local college level, faculty members who are well connected to industry become brokers of knowledge and ideas that promote technology and knowledge transfer within clusters. Proactive colleges organize business alliances that accelerate these types of learning and collaboration. It is this regional focus that presents technical colleges with the opportunity for cluster specialization.

Technical colleges are capable of absorbing this broad set of missions because, as the youngest member of South Carolina's educational infrastructure, they have fewer ingrained traditions, less rigid organizational structures, closer ties to local industry, greater nimbleness in responding to changing local labor markets, and less resistance to change. That does not mean they face no resistance to change but that the hurdles are lower.

ALIGNING WITH DEMAND-DRIVEN CLUSTERS

Focusing on the workforce needs of regional industry clusters is a way to build on local strengths and to fuel the engines that can pull regional economies up the steep hill of economic recovery.

Sharpening Washington's Competitive Edge,
Washington State Board
for Community and
Technical Colleges, 2003.

A great deal of natural alignment already exists within the state's technical college system, in part through a derivative of the state's technology centers and in part through a response to regional customer demand. For example, only Florence-Darlington Technical College offers a degree program for chemical engineering technology; Midlands and Trident Technical Colleges, located in two of the state's largest cities, are the only colleges to offer commercial graphics and telecommunications systems management; and Spartanburg Technical College alone offers a degree in industrial electronics with an automobile manufacturing option. All technical colleges make choices among the degree and diploma programs they offer that reflect local employer demands. The key to aligning South Carolina's technical colleges with clusters is to build on existing specialization beyond programs to add additional responsibilities and services that more proactively serve clusters.

Choosing the right clusters

Two of the three recent economic development plans for South Carolina identified, albeit with some caveats, key business clusters based on analyses of employment and enterprise data honed by focus groups of employers. The most recent study by the Monitor Group highlights four clusters—automotive, chemicals, textiles, and tourism—and adds “local clusters” to represent the state's

retail sector and urban services. It also notes that other clusters will undoubtedly turn up as regions assessed their local strengths in more depth.

In its latest report, the Monitor Group, identified clusters by industrial sectors and geographic boundaries. Those are critical variables in determining alignment of the state's workforce development system with clusters. To present a more comprehensive alignment, the technical colleges can add valuable insight regarding local economies. They should be actively engaged in their own regions' analyses to ensure that no clusters and no collective opportunities are overlooked.

For example, are there groups of companies on different sides of state lines that, if aggregated, would comprise a cluster? Are there concentrations that are significant at the sub-regional but not state level? Would the inclusion of the more than 200,000 firms in the state with no employees and many more that generate unreported or part-time income reveal additional clusters with growth potential? The workforce development system, because it works closely with numerous employers and is aware of their needs, is likely to have a good understanding of relationships and commonalities that define certain groups of firms as clusters.

A Framework for Cluster Hubs within South Carolina's Technical Colleges

The concept of a cluster-oriented technical college system is based on the following set of assumptions:

- Every technical college will not have the resources to provide high quality education, training, and services to all industries. Only by specializing can institutions and systems assemble expertise and resources to meet current and future workforce needs and ensure that employment in clusters spans a wide range of technical and non-technical occupations.
- Employment in any cluster spans a wide range of technical and non-technical occupations, and many of the workplace skills apply to other industry clusters.
- Sustaining excellence requires continual monitoring of industry trends, benchmark practices, and new technologies.
- All students should have access to education and training to prepare them for a career in any chosen cluster and to pursue education to the fullest extent of their abilities and aspirations.

1. Education and Training Providers as Stakeholders in Clusters

Clusters are defined by the nature of the relationships among their member companies and supporting institutions. Some of the particular interdependencies that exist between colleges and companies are obvious, some subtle. Some are reactive and others proactive. Technical colleges not only can fill industry's requirements for skilled and technically proficient workers but also serve as repositories of information and technology as well as sources of expertise, advice and assistance. For the most part requirements can be classified as:

- *Education and training*: including workforce preparation, entrepreneurial education, worker training, management education, and educational support services;
- *Business services*: including technology diffusion, business incubators, small business centers, testing labs, and technical advice;
- *Brokers of collaboration*: including organizing training alliances or networks, conferences and forums;
- *Information source*: including industry trends, marketing materials, benchmarking, workforce, training opportunities, technical library;
- *Measurements and accountability*: including identifying skill standards, conducting needs assessments, measuring performance.

2. Building a System of Cluster Hubs and Spokes

The current alignment of workforce development with clusters is somewhat akin to the alignment of workforce development with specific technologies two decades ago. It requires making choices in the allocation of resources among colleges that make good fiscal sense because they create economies of scale. They also make good economic sense because the colleges better meet the needs of industry, and they make good social sense because they expand career opportunities for individuals.

South Carolina has made such choices in the past. The state's "Design for the Eighties" challenged technical colleges to be more responsive to employers including the growing number of foreign-owned firms, and to their expanding use of more advanced technologies. That plan eventually led the technical college system to establish eight Advanced Technology Centers, each empowered to build expertise in a specific technology deemed essential to economic growth. Those Centers included: Advanced Machine Tool Technology, Microelectronics,

Electronic Maintenance, Office Automation, Tourism, Environmental Training, Computer Applications, and Robotics. More recently, the Governor's Workforce Education Task Force recommended regional service centers to link business and industry.¹⁹ Some colleges are adding new Centers, such as Midlands Technical College's Center of Excellence for Technology Training. While not targeted to a specific industry, the large number of advanced manufacturing and IT companies in the region are likely to dictate the emphasis.

The new focus on clusters suggests a new generation of technical college-based centers, or hubs, that differ in substantial ways from the technology-based centers of the 1980s and 1990s. The Advanced Technology Centers (ATCs) created a legacy of innovation. However, current needs require that technical colleges shift their focus to the needs of industry clusters. For example, the ATCs were driven by process technologies, were closely linked to the companies that made them, and emphasized demonstration. Today's cluster hubs emphasize specialized knowledge, are more tightly linked to industry or cluster associations and rely heavily on shared information. The cluster hub, by specializing, is able to build strengths and develop expertise and knowledge not possible if left to individual businesses.

Cluster Hubs do not only hold classes or provide advanced technology; they are part of a cluster's "knowledge network." Successful firms now view education and training as a continual process, and they need colleges to be part of their knowledge networks in order to enhance companies' access to new skills and information on a regular basis. *For the colleges, the challenge is not simply to provide entry-level skills to workers but to develop high-level and sustained interaction with firms in their regions that continually transfer knowledge back and forth.* South Carolina's technical colleges can play a central role in transmitting such knowledge between important clusters of firms across the state.

By functioning as part of a knowledge network, Cluster Hubs serve as a one-stop shop for an industry cluster—a place where member firms go for help in translating their workforce needs into education and training requirements or for expertise that can spur improvements in their competitiveness.

For example, the Hosiery Technology Center at Catawba Valley Community College in North Carolina, a collaborative venture of the community college and an industry association, is an excellent example of a Cluster Hub. With equipment ranging from the oldest to the latest computer-aided knitting machines, the center trains repair technicians, knitters, and managers and is developing training programs for dyers. The firms rely on this center not only for education

¹⁹ Governor's Workforce Education Task Force, *Pathways to Prosperity*, Columbia: Office of the Governor, October 2001.

and training, but also for information about technologies and markets, and as an intermediary to spur new technology R&D.

Finally, the cluster approach has an important impact upon the learning of working adults. Many adults performed poorly in school in part because they never made the connection between their education and the workplace. The classroom became a series of abstractions unrelated to the economy. One of the consistent findings of surveys of adults is how little they believe their formal education prepared them for their jobs. Simply sending adults back into classrooms does not change these perceptions. However, an education program designed and developed with the input of a cluster of firms is far more likely to reflect the needs of the workplace. In addition the academic courses can be connected to economic opportunities, which help to motivate adults. A cluster approach will aid technical colleges in fulfilling their educational missions to bring critical job skills to their local working populations.

The Current State of Cluster Specialization

Some states and some nations have already begun on the path towards cluster specialization.

- North Carolina contracted for a plan but allocated first funds to the bioprocessing cluster hubs—one of which will be located at a university campus—with the hope that the budget will later allow for other cluster hubs to follow. The state's Golden Leaf Foundation awarded the system nearly \$10 million to support the startup of the plan.
- Washington established a statewide plan that included hubs for process manufacturing; power plant operation; agriculture; allied health; materials; manufacturing technologies; and viticulture. Each region of the state has identified the clusters on which it will focus its efforts. In many places colleges already have particular programs and expertise for the designated clusters as a result of labor market demand.
- Montana is in the process of designing cluster hubs at colleges for six clusters identified in a recent study: the state's creative enterprises; wood-based; experience enterprise; and life sciences, food processing, and information technology.
- Wisconsin has named specific technical colleges to support regional clusters and is beginning the process of creating cluster centers.
- In California, the State Education Code requires community colleges to

focus on “industry clusters within a region.” The largest effort has been a consortium to address biotechnology in which various colleges develop different specializations.

- Mississippi has a state design that analyzes clusters by community college district and calls for each college to develop a cluster hub based on greatest local needs. Some colleges have already assumed leadership in particular clusters such as information technologies, automotive, and furniture.
- Great Britain has created Sector Skills Councils around various key clusters that are composed of industry leaders. The councils are charged with providing leadership in boosting skills and productivity, improving learning, establishing apprenticeships, and setting standards. Great Britain also has a program for funding the Center of Vocational Excellence at Further Education Colleges (British equivalents of technical colleges) that choose to develop expertise in a particular industry specialization.

Aside from these statewide (or in the case of Great Britain, national) efforts, dozens of individual colleges have developed some level of special expertise for a cluster. What causes colleges to specialize? Research of nearly 100 such institutions shows that colleges choose to specialize in response to local demand or anticipated demand, or is driven by opportunities for external funding from sources such as the National Science Foundation. Demand is most common reason for college specialization. The NC Hosiery Technology Center was the result of unmet demand by the industry and a special legislative appropriation.

Some places develop programs in the hopes of attracting or developing a cluster. The most common are in new and emerging industries where only a few seeds exist, such as biotechnology, nanotechnology, or environmental technologies, but some target tourism or viticulture hoping for future growth. Many of the colleges that already do, or want to, target biotechnology cannot yet claim a cluster—and may never achieve that goal.

Opportunity is yet another reason for specialization, although most are linked to either existing or potential demand. The primary source is the National Science Foundation’s Advanced Technical Education program, which has funded centers across the nation, but potential funding for homeland security is causing colleges to quickly develop new competencies.

Examples of Clusters Selected in South Carolina as Prototypes

Many colleges operate as cluster hubs, even without any awareness of the concept of clusters. A few examples from the four clusters targeted in the Monitor report are described below.

1. Auto suppliers

Because the auto supplier cluster is large and complex, these hubs may focus around particular auto supplier specializations such as tool and die firms, precision metal manufacturing, or plastic part making.

- **Macomb Community College** in Warren, Michigan has been recognized for its superior automotive programs. The program provides three distinct opportunities: CAP (College Automotive Program); ASEP (Automotive Service Educational Program); and an automotive technology program. The CAP and ASEP programs are collaborative efforts between the college, Daimler-Chrysler, and General Motors. These programs prepare students for technician fields within an automotive dealership. The automotive technology program trains students with technical skills to diagnose, repair, and maintain the systems within a modern automobile. The programs industry partnerships serve as a catalyst for practical co-op and internship opportunities for students.
- **Holmes Community College** in Goodman, Mississippi has been tapped by the State of Mississippi to provide training support to Nissan and is the state's choice as the lead college for a dedicated automotive cluster hub. Holmes will take the lead in developing and sharing specialized automotive-related curricula and instructors with other of the state's fifteen Workforce Development Centers, but Hinds Community College will play a key supportive role. Prior to the Nissan plant opening, Holmes prepares students to service and maintain all types of automobiles. The program had a close partnership with the Toyota Corporation and created the Toyota Technical Education Network that combined on-the-job training with classroom instruction.
- **Triton Community College** in River Grove, Illinois provides an advanced automotive repair/technology program. The program specializes in auto repair, auto technology, and auto mechanics. The college has a strong partnership with Chicago's O'Hare Airport and is responsible for managing automotive repair operations at the airport's car rental agency. Students are able to gain practical experience and get specialized training. Graduates of the program encounter high job placement.

2. Tourism

Tourism is becoming an increasingly desired cluster in rural areas to replace a diminishing agricultural or industrial base. The most effective programs focus on the core of the cluster that attracts visitors as well as the more traditional hospitality support structure, and designs programs to include career pathways for low wage entry-level jobs.

- **Hocking Community College** in Nelsonville, Ohio has become internationally known for its adventure travel and ecotourism programs. The program focuses on tourism that is environmentally sound and economically sustainable. The program provides an associate's degree in tourism and trains students to obtain jobs with travel agencies, private eco-tour sites, zoos, museums, and tourism related occupations. The program encourages students to take courses involving tourism entrepreneurship and management.
- **Vista Community College** in Berkeley, California has met the needs of the quickly changing travel industry by training students in an array of tourism related areas such as marketing, group tour design, customer service and travel production knowledge. The program provides six travel industry certificates that range from cruise and air specialty certificates to travel industry professional certificates. The program is able to offer students practical experience through an internship through partnerships with multiple private travel agencies in the San Francisco/Berkeley Bay area.
- **Vancouver Community College** in British Columbia trains people to directly enter British Columbia's #1 employer, the hospitality industry. Students are able to receive a diploma in tourism management and take advantage of the program's various opportunities. The program offers a hotel simulation course and other cooperative education events. Graduates of this program have found employment in the local economy and are trained to fulfill management positions.

3. Chemical processing

Chemical processing, including oil, gas and pulp, is a highly specialized field that requires skill sets that are different from discrete part manufacturing. The National Science Foundation has taken the lead in building the capacity within certain colleges located in clusters to develop the necessary work force.

- **Alabama Southern Community College's** Center for Excellence in Forestry, Paper, and Chemical Technology (CEFPCT) was created through collaboration by a host of statewide agencies including the Alabama Technology Network, Auburn University, Boise Cascade and the Gulf States Paper Corporation. The National Science Foundation-funded ATE Center offers technical training in Alabama's largest industries (forestry, paper, and chemicals) and related specialized training in electrical technology, forestry technology, timber harvesting, paper and chemical technology, and industrial electronics. This training is accomplished using state-of-the-art techniques and equipment.
- **College of the Mainland** in Texas City, Texas hosts the Center for Advancement in Process Technology. Its mission is to lead education, industry and government in developing the skilled process technology workforce and to close the gap between the high demand for skilled process technicians and the current supply. The Center has strong partnerships with Exxon Mobile and BP (British Petroleum) and is located in the largest complex of petrochemical businesses in the nation. Concerning process technology, the Center offers training, professional development, and resources for students, educators and industry.

4. Textiles and Apparel

While the part of the industry that mass-produces low-end goods is in decline, a strong market still exists for high-end designer goods. Effective colleges are adding programs in design and lean manufacturing to respond to smaller but high cost customer demands.

- The Hosiery Technology Center at **Catawba Community College**, Hickory, North Carolina was established with a direct appropriation from the state legislature to support the state's large but endangered hosiery cluster. The Center offers training, management education, seminars, and technical assistance through a local university extension engineer; it provides a testing laboratory, demonstrates new equipment, organizes marketing networks, manages the clusters web site (www.legsource.com), and facilitates networking.
- **The North Carolina Center for Applied Textile Technology** in Belmont, North Carolina is dedicated to teaching textile technology through cooperative arrangements with institutions across the state. The Center offers the North Carolina Manufacturing Certification program as well eleven other certificate programs related to textiles such as yarn manufacturing, weaving, dyeing and finishing. The Center also provides

training and technical assistance, usage of new textile equipment technology, and industrial management services.

- **The Institute of TAFE** in Tasmania, Australia provides diploma and certificate programs for textiles, clothing, and footwear that reflect the latest industry practices. Training is provided in the workplace of many businesses and produces self-reliant employees with generic skills. The program also offers electronic learning resources and opportunities for students to work with businesses on real industry projects.

Principles Underlying Cluster Hubs

These design principles stem from an array of cluster studies in various parts of the world, experiences with educational institutions that support business clusters, and knowledge of states' policies, institutions, and clusters. There are a number of general principles that are associated with success. The technical college system should:

Be employer driven

Curricula, programs, and services should be influenced by current and emerging needs of the cluster as best articulated by the leaders and innovators and by best practices, not by political considerations. This can mean that on the demand side, the firms that appeared to be most likely to survive and grow and offer high wage employment to the community are the clusters worth considering by the community college.

Work in partnerships

Cluster Hubs should work closely with organizations whose missions overlap or complement their own, (e.g., development agencies, universities, non-profits, and other colleges, directing customers to other organizations where appropriate). They should share specialized resources and expertise freely and proactively with all institutions in the state in order to help colleges assist firms not located within the cluster's larger concentrations, particularly rural areas. Hubs should take part in national and international networks and associations that help the college to stay abreast of new innovations and best practices, access new materials and curricula, and build international recognition.

Stimulate economic development

Cluster Hubs should be a driving force for the economic development of communities, regions, and states by helping to attract new firms and by helping existing firms expand and compete. Cluster Hubs tend to make colleges flexible and able to react swiftly to changing market demands, partly because they challenge some of the traditional organizational and decision-making structures of the colleges. For example, the most effective Hubs bring technical curricular programs and non-credit customized training (in South Carolina, the Center for Accelerated Technology Training) closer together, because they work to provide a “whole industry” approach that encompasses both educating youth and upgrading skills of current workers. Hubs are most effective if they hire some management and faculty with recent industry experience and encourage them to remain active in their industry and professional associations.

Develop the future workforce with career ladders

The makeup of South Carolina’s workforce is changing and will continue to for decades to come. Many industries including manufacturing and tourism have a critical need for employees in jobs that are neither currently popular nor offer high entry level wages. In order to meet the current and future demand for mid-level skilled technicians, it is essential that more people enter into technical programs at the state’s technical colleges.

In order to motivate more students to fill that demand, colleges and employers must be able to show students that there are pathways for advancement. An industry cluster approach is compatible with the development of career clusters as recommended by the Governors’ Workforce Education Task Force. Industry clusters make advancement opportunities more transparent. One example of this is the South Carolina Advanced Technological Education (SC ATE) Center of Excellence at Florence-Darlington and Piedmont recognizes that is working diligently to attract more women and minorities into the Engineering Technology field. The cluster hub approach provides a tangible pathway and uses strong employer partnerships to attract potential workers.

Functions of College Cluster Hubs

Cluster Hubs can do many things to meet a cluster's needs. The following are examples of functions that are carried out by some colleges in some places *to complement or supplement their education and training programs*. No college has attempted to do everything suggested. The priorities for any single Cluster Hub depend on availability of resources, internal capacity and expertise, firms' access to other support agencies or service companies for these functions, and the needs of the cluster. Typically, in rural areas where fewer sources of support and expertise for employers are available, colleges do more than in large metro areas.

Cluster Hub Functions

- Develop new curricula using direct industry input
- Monitor cluster trends, assess needs
- Create skill standards as needed
- Facilitate workplace learning
- Participate on cluster councils
- Promote cluster-related entrepreneurship
- Conduct global benchmarking, retain global perspective
- Build regional skills alliances
- Advance cooperation between all levels of the education system
- Host and deliver complementary services
- Provide cluster information portals
- Be flexible and accountable

Develop new curricula, using clusters for context

Cluster Hubs assume leadership for reviewing curriculum content in light of employer and student feedback. They also lead in modifying and expanding curricula, developing new courses of study, programs, and special concentrations as needed.

The context in which learning occurs matters, as the Governor's Task Force implied when it recommended that curricula include practical rather than purely theoretical content. Educators classify their programs by occupation, but workplace skills are defined by the context in which they are applied and vary from industry to industry. Network administrators working in a division of a large multi-national corporation, a government

agency, and a small service company all have different skill requirements and must operate in different business cultures. By designing curricula around the workplace and business of firms in a local cluster, colleges ensure that students appreciate the value of the cluster, understand more about their regional environment, and perhaps be more inclined to follow career paths in the cluster. Additionally coordinating the design of new curricula with the state's research efforts provides students with clear pathways to choose careers that will support the needs of business and industry. This educational approach raises school retention rates and education achievement levels because it makes the content of the education more relevant to a community's economy and student's life.

Monitor cluster trends, assess needs

Colleges need to know what skills and knowledge the industry expects and wants. The hub can orchestrate the process of collecting such information, particularly for clusters that are not easily defined by standard industry codes. Colleges rely on employers in the development of new occupational curricula. For example, South Carolina, worked with Concurrent Technologies Corporation to carry out an extensive industry needs assessment in six industries in 1999 under a grant from the U.S. Department of Commerce.²⁰ A cluster hub would consolidate that process at a single institution to minimize the burden on companies and increase efficiencies.

Create skill standards as needed

Full acceptance of the voluntary National Skill Standards enacted by Congress has proven elusive, in part because industry is not well enough organized at the national level to demand them. However, in selected areas and for selected industries, standards do exist and are being used. Some states (e.g., Washington, Illinois) and some professional associations have developed their own sets of standards. Indeed, one of the problems is that there are too many different sets of standards and too little attempt to consolidate them into something that has local cluster support. Standards are much more common in other industrialized nations where industry and labor have more formal roles in technical education. A Center can track existing standards and work with the cluster council towards agreement on a set of standards that will lend more credibility in the skills and knowledge associated with credentials.

²⁰ Enterprise Development, Incorporated, South Carolina Workforce Initiatives: Six Industry Action Plans.

Facilitate workplace learning

Centers can help pave the way for internship or apprenticeship programs for students, and externship program for faculty by working through the cluster organization to find positions and mentors. Employers prefer graduates with experience in a real or simulated business operation. Internships give students the hands-on experience companies want, and the externships give faculty a better understanding of the newest technologies and of the daily environment in which their students will work. Internships also allow firms to become familiar with the students and the strengths and gaps in their college education. Finally, they build connections to employment opportunities, which is particularly important for non-traditional students. Internships could be strengthened if employer/mentors are well prepared and rewarded, if students can get high school/college credit, and if interns and externs are paid something for their efforts. One successful example is a program developed with two New York IT associations to place student interns in member firms. Employers are eligible for 50 percent reimbursements of interns' salaries up to \$1,000 per semester (<http://www.nysia.org/internships.htm>). They also sponsor externships for faculty so that they become more familiar with technologies and skill requirements.

Participate on cluster councils, invest in social capital

It is important that the Cluster Hub represents the region or state in any organization that is designated to, or acts by default, in representing or speaking for the cluster. If non-businesses are permitted membership, the Hub should be a member or, if not, an associate or affiliate of such organizations. Federal technical and career education and training policies now require states and institutions to work with industry. But industry partners are selected at random, often because of their large size, and members are rarely in a position or empowered to speak on behalf of their industry. Clusters represent a collective voice for the private sector and therefore are more effective in the design and development of educational programs. The Northeast Oklahoma Manufacturers Council is an example of a council created by a technical college that was so successful it ultimately was adopted as a statewide strategy and formed in every region. Where councils are already formed, the college ought to link itself to the organization and, where they are not, the college should become the catalyst for organizing the committee. The most effective councils are those that officially represent and can speak for their industry, not just for their companies.

Promote cluster-based entrepreneurship

We know that clusters grow through entrepreneurial spin-offs and that these companies are of tremendous economic development value. Cluster Hubs can support this activity by providing technical assistance to potential entrepreneurs with specific information about the business environment and issues related to starting a firm in the cluster. The Hub may also augment existing generic entrepreneurship curricula that most colleges use with tailored modules that are specific to the cluster and address the issues highly pertinent to a cluster start up. Another activity is to form and support entrepreneurs' networks where individuals come together to learn from and support each other as they start their own companies.

Conduct global benchmarking, retain global perspective

Colleges, like companies, face the danger of falling behind their competition if they become too inward-focused and fail to continually benchmark best practices and approaches, wherever they might occur. Learning about and observing innovative approaches—and then improving upon them—can lead to international recognition. Innovation is a collective process, and the broader the range of experiences and histories of the participants in the process, the more apt they are to conceive of an innovative improvement. South Carolina has a distinct advantage with its large numbers of international employers for assuming national leadership in this area.

Build regional skills alliances

Small firms have under-invested in training. Some reasons for that might be fear of losing investments to competitors, too few employees to justify special programs at colleges, or economic pressures. One of the goals of Manufacturing Extension Partnerships has been to encourage small and mid sized enterprises to provide more training for their employees, and one means is to combine their needs in order to achieve a scale that will justify public sector attention or reduce costs to employers. The U.S. Department of Labor (DOL) has been encouraging such collaboration as Regional Skill Alliances. Where companies are clustered, more opportunities for building skills alliances exist. Connecticut, as part of its official cluster initiative has funded eight regional alliances called training networks. They include the Metal Manufacturers Training and Education Alliance (11 members), Housatonic Education for Advanced Technology (7 electronics companies), Fairfield County Information Technology Consortium (8 IT companies), and the Connecticut Association of Metal

Finishers (6 finishers). Among the most successful skills alliances is the 30-member Technology Coast Manufacturing and Engineering Network, managed by Okaloosa-Walton Community College in northern Florida. In 2001, South Carolina developed plans for such alliances in six industries under a grant from the DOL.²¹ Colleges that work with a set of industries with common skills and knowledge needs and common context are already positioned to broker these training networks.

Develop and align articulation agreements between education sectors

A Cluster Hub is a key player in strategies to create more seamless pathways from secondary education through two-year and on to four-year colleges. Because the Hub understands a cluster's needs, it can communicate effectively and serve as a focal point for developing articulation agreements that serve both the cluster's entire labor force needs and employees' aspirations. Many high school counseling offices do not have sufficient understanding of individual industries to give informed advice to students concerning career paths. Tech Prep programs may help but are focused on occupational clusters with little context or knowledge of cluster-based career paths. Particularly in clusters facing skill shortages, hubs should take the lead in building relationships, such as arranging industry visits, developing dual enrollments, and establishing cluster-based tech prep tracks. Clusters can also help identify institutions with baccalaureate program opportunities that will transfer credits already earned for employees with applied associate degrees.

Host and deliver complementary services

A two-year college offers a convenient and easily accessible site for hosting complementary services for the cluster. The most obvious is the Manufacturing Extension Partnerships, which may host engineering staff at colleges to connect training and modernization needs of SMEs. Some colleges, such as Okaloosa-Walton in Florida and Hagerstown in Maryland, host economic development offices to develop the cluster as well as to promote the regional economy. Hosting makes it very easy to coordinate activities and share information on a day-to-day basis. A number of colleges run business incubators as an economic development strategy, as opportunities for graduates or faculty, and as a potential co-op experience for students. Some incubators are generic but many have

²¹ Garry Powers, South Carolina Workforce Initiatives: Six Industry Action Plans, Columbia: Enterprise Development, Incorporated, 2001.

focused on specific clusters, such as biotechnology at Asheville-Buncombe Community College in North Carolina, metals at Hagerstown Community College in Maryland, and the Arts at LaGuardia Community College in New York.

Provide cluster with an information portal

Most companies are bombarded with information about education and training opportunities and job applicants. With listservs, mass faxes, mailings, television ads, personal telephone calls, and visits, companies have more information than they can possibly sort through and use. Successful cluster workforce portals can tell firms which trainers understand their business and best fit their needs because they have special equipment, instructors with experience in their industry, or a track record with the cluster. The difference between a cluster-based portal and typical one-stop shop is the focus on customization and specialized skills and needs. The best of these portals are integrated with other cluster information to give members a single source in which workforce is part of a larger competitiveness picture. Joint Venture Silicon Valley, the Hosiery Technology Center, and the Pennsylvania Economy League have developed these cluster workforce information portals.

Be flexible and accountable

Clusters are not stagnant, and must constantly change and respond to market shifts. It is important that Cluster Hubs do not become too entrenched in their initial set of services and activities. There is a natural tendency for colleges to continue programs or activities once they have started because changing programs or staff is too difficult. This is dangerous because the Hub's value lies in its ability to evolve with the cluster it serves. For example offering lean manufacturing assistance to firms may be important for a couple years, but at some point it may no longer prove critical. There should be annual comprehensive reviews of the Hub's activities by an employer-driven board or advisory committee. The more authority the group has to direct the Hub's services, the better.

CONCLUSIONS

IN SUPPORT OF A CLUSTER STRATEGY

The central role of skill development and an educated work force in cluster-based strategy is irrefutable, and it is likely to become even more important as more knowledge dependent clusters emerge and grow. South Carolina's system of technical colleges, already nationally recognized in its economic development role, must take the lead to implement the following steps:

Recommended actions

- 1. Align the state's strategic needs to include a workforce development system that provides workers with the skill and context needs of industry clusters.**

If specialization among colleges is defined in terms of levels of expertise, information and knowledge that are shared across the state, then every college gains from alignment with clusters without relinquishing any of its enrollments. Choices of where and how to specialize ought to reflect local demand and institutional strengths.

- 2. Work with and through cluster organizations in planning, developing, and supporting, cluster-oriented activities.**

The technical colleges should be involved at the beginning in cluster development planning and strategy. Cluster organizations are best managed by their own members, but colleges' focus on the local economy, impact on local skill levels, diversity of missions, and array of connections with employers make them valuable partners.

- 3. Work with research institutions to develop associate degrees and technical certifications required to provide the workforce essential to commercialize new technologies developed in the state.**

Manufacturing and technology driven employers that comprise South Carolina's clusters continually need workers with advanced technical skills. It is essential that the technical colleges work with other educational institutions to create relevant degrees and programs that will prepare

people for these jobs. Collaboration will allow the state to fully leverage the efforts of the endowed chairs program and to ensure that research centers of excellence have available the full range of workforce skills required to commercialize new technologies.

4. Build international education into workforce development programs and set globally competitive standards.

South Carolina has many large international employers. Introducing more international content or course options into workforce development programs would give students added value to those employers who operate in global environments.

5. Continue and expand efforts to reach underemployed workers and increase enrollments and completion of postsecondary programs.

Technical colleges play the most critical role in providing the education and training that allow thousands of South Carolinians to earn a better job and improve their quality of life. A cluster-oriented approach will provide incentives to working but underemployed adults and to youth who may not have otherwise continued their education.

6. Create a seamless and open-ended system of workforce development that identifies students from high school who choose workforce-oriented programs at technical colleges and, for those aspiring to higher levels, directs them on to baccalaureate programs.

One way to entice youth into industrial programs is to ensure that they have options to continue their education. Keeping possibilities open increases the status of workforce programs and draws more talented youth into them. The goal should be to allow any individual to reach his or her highest potential without limits. Programs such as tech prep, dual enrollments, and middle colleges ease the transition to postsecondary commercial and technical programs. More focus should be given to conversion of non-credit and informal learning to credit bearing skills as well as to the transition on to baccalaureate programs. While all levels of education and training are important to industry clusters, technical colleges are critical for success. They have a primary responsibility for educating a regional labor force that understands and is skilled in the work of the industry. They also provide a system able to generate a pool of new entrants and to upgrade the skills of existing workers.

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